Converging Voice and Data over Mission-Critical Networks

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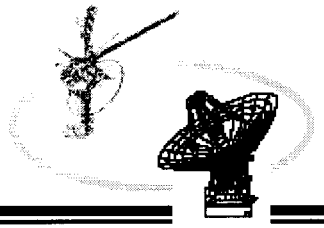
Background



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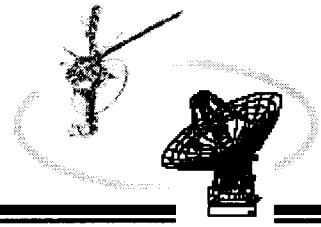
- Operational voice is used by Deep Space Mission System (DSMS) mission operations personnel to communicate verbal commands, status, marking conditions, and safety instructions.

- During a typical mission track, sequence operations personnel use the voice capability to communicate valuable mission parameters including spacecraft downlink state and health.

- Real-time mission tracking parameters are also communicated between the Project Operations Centers (POCs), and the antenna facilities.

- The traditional DSMS voice architecture includes a central Raytheon Multi-Conference Digital Switch (MDS-1) to connect distributed users.
  - Dedicated circuits
  - Analog signals to 4-wire-interfaced end instruments.

Voice over IP (VoIP)



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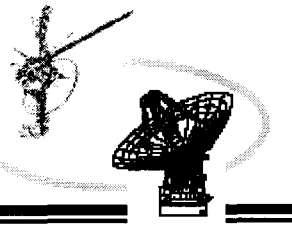
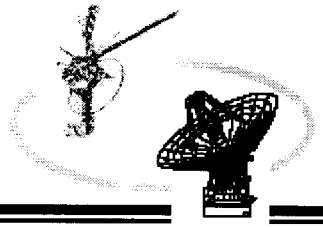
- There is a private DSMS IP data network capable of packet prioritization.
- Voice can be encoded into Internet Protocol (IP) networks based on ITU H.323-series standards.
- Enables voice to be packetized into standard IP format to be carried on the DSMS IP-based ground network.
- VoIP traffic stream of much smaller bandwidth, e.g. 8 kbps vs. normal 64 kbps per channel.
- In addition, experience has shown during a day, voice only uses bandwidth 3-6% of the time.

Quality of Service (QOS)



- Voice has inherent quality demands and hence requires preferential treatment traveling through data network.
- A number of QoS techniques are deployed to ensure co-existence of voice and data on the same IP network.
- Prioritized with highest priority over the DSMS routers for highest quality.

Implementation



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- Initial operational voice pilot was implemented to support Space Infrared Telescope Facility (SIRTF) development between Pasadena, CA, and Sunnyvale, CA.
  - Across a T1 dedicated circuit in 1999.
  - The VoIP was allocated 12 kbps of bandwidth, with the balance for TCP/IP data.

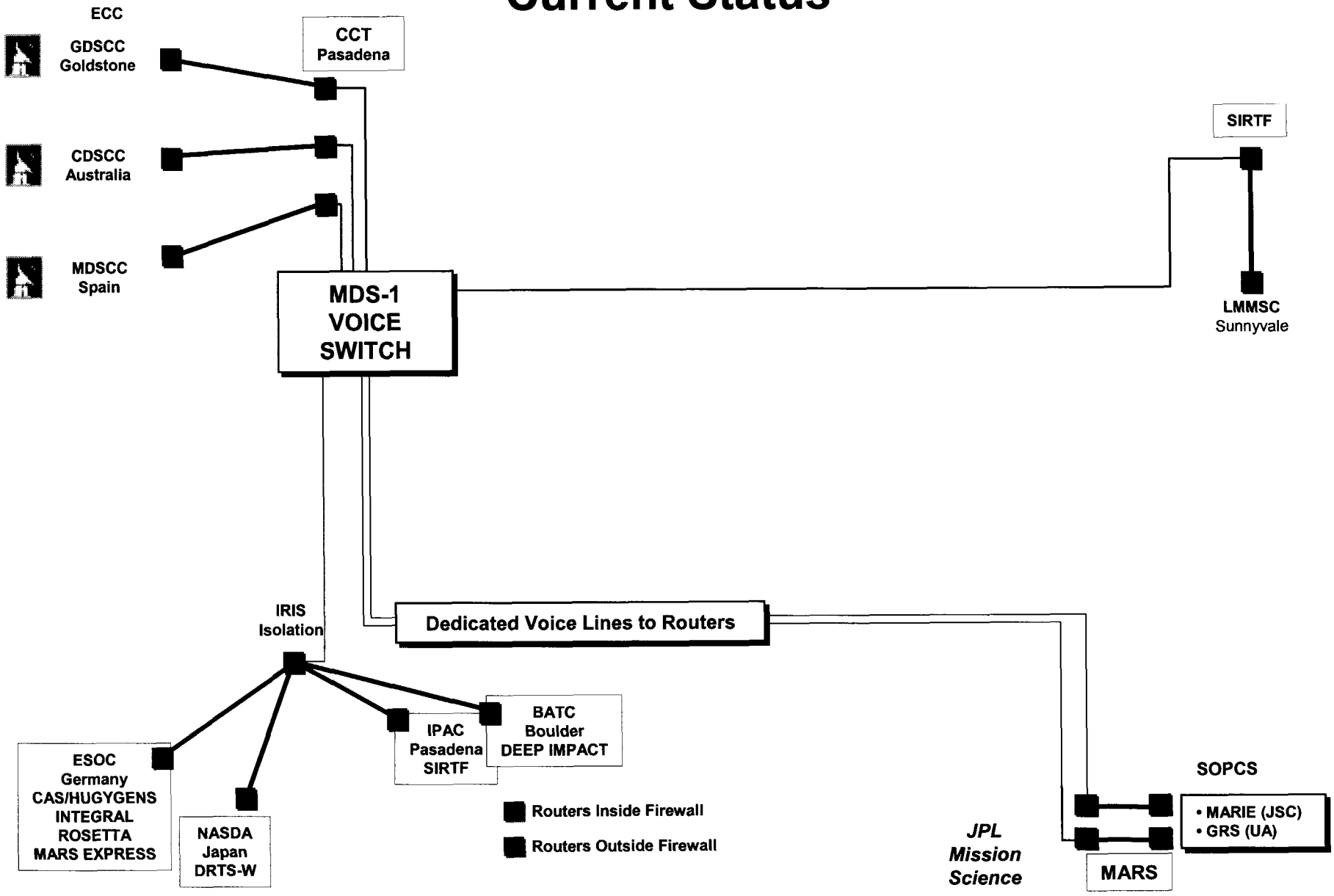
- Based on this success, an operational system was installed to support two Project Operation Centers (POCs) for Mars Odyssey, at Arizona State University and University of Arizona.

- Additional installations followed to support Cassini's Huygens Probe Operations Center (HPOC) in the European Space Operations Center in Darmstadt, Germany, and the Deep Space Communications Complex (DSCCs) in Goldstone CA.

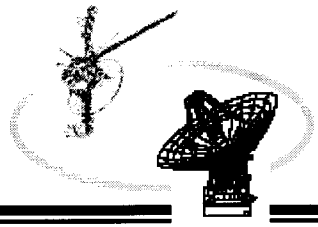
- Plans are to transition to VOIP in the DSCCs in Canberra, Australia, and Madrid, Spain.

Ops Voice over IP

Current Status



Results



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- The architecture has proven to be very robust and has resulted in significant cost savings.
  - Eliminates separate voice circuits
  - Increase robustness because of redundancy built into the data network.

- Limited to WAN communications until the LAN can support priorities required for quality VOIP.

Next Steps

- Transition the LANs at the DSCCs to a type able to support VOIP over the LANs.

- Deploy appropriate end instruments at DSCCs (with Ethernet interfaces rather than 4-wire interfaces). Instruments under development.

- Deploy an IP-based central switch.